STATION CIRCULAR 89 JANUARY, 1929

The Jerusalem Artichoke

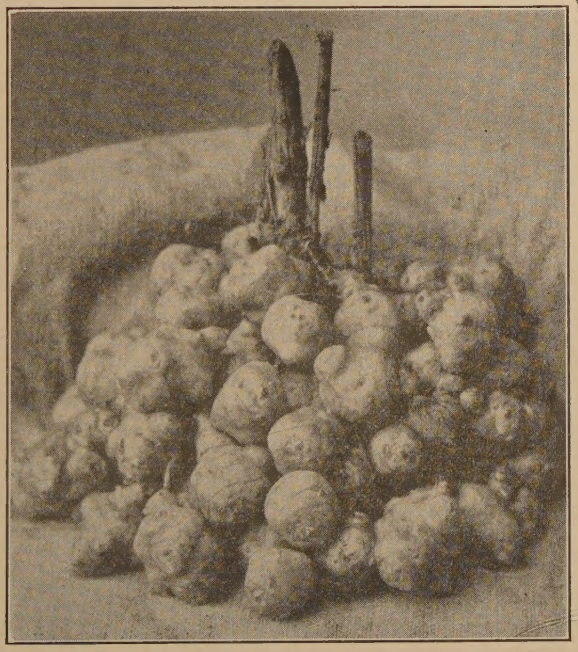

Fig. 1. One hill of Mammoth French White artichokes.

Agricultural Experiment Station
Oregon State Agricultural College
CORVALLIS, OREGON

UNIVERSITY OF ARIZONA
LIBRARY

REGENTS OF OREGON STATE AGRICULTURAL COLLEGE

Hon. J. K. Weatherford, *President*.....*Albany*
Hon. E. E. Wilson, *Secretary*.....*Corvallis*
Hon. B. F. Irvine, *Treasurer*.....*Portland*
Hon. I. L. Patterson, *Governor*.....*Salem*
Hon. Hal E. Hoss, *Secretary of State*.....*Salem*
Hon. C. A. Howard, *Superintendent of Public Instruction*.....*Salem*
Hon. George A. Palmiter, *Master of State Grange*.....*Hood River*
Hon. Harry Bailey.....*Lakeview*
Hon. Geo. M. Cornwall.....*Portland*
Hon. E. B. Aldrich.....*Pendleton*
Hon. Jefferson Myers.....*Portland*
Hon. J. F. Yates.....*Corvallis*
Hon. H. J. Elliott.....*Perrydale*

STAFF OF AGRICULTURAL EXPERIMENT STATION

W. J. Kerr, D.Sc., LL.D.....*President*
J. T. Jardine, B.S.....*Director*
E. T. Reed, B.S., A.B.....*Editor*

H. P. Barss, A.B., S.M.....*Plant Pathologist*
F. D. Bailey, M.S.....*Asst. Pathologist, Insecticide and Fungicide Bd., U. S. D. of A.*
R. S. Besse, M. S.....*Associate in Farm Management*
P. M. Brandt, B.S., A.M.....*Dairy Husband'n*
P. Brierley, M. S.....*Assistant Pathologist, United States Department of Agriculture*
A. G. Bouquet, B.S.....*Horticulturist (Vegetable Gardening)*
E. N. Bressman, M.S.....*Assoc. Agronomist*
G. G. Brown, B.S.....*Horticulturist, Hood River Branch Exp. Station, Hood River*
W. S. Brown, A.B., M.S.....*Horticulturist in Charge*
D. E. Bullis, B.S.....*Assistant Chemist*
A. S. Burrier, M. S.....*Assistant in Farm Management*
Leroy Childs, A.B.....*Superintendent Hood River Branch Exp. Station, Hood River*
G. V. Copson, M.S.....*Bacteriologist*
H. K. Dean, B. S.....*Superintendent Umatilla Branch Exp. Station, Hermiston*
C. R. Donham, M.S., D.V.M.....*Assistant Veterinarian*
E. M. Dickinson, D.V.M.....*Assistant Poultry Pathologist*
W. H. Dreesen, Ph.D.....*Associate Agricultural Economist*
T. P. Dykstra, M.S.....*Assistant Plant Pathologist, U. S. Dept. of Agriculture*
F. M. Edwards, B.S.....*Asst. Animal Husbandman, East. Ore. Br. Exp. Sta., Union*
A. E. Engbretson, B.S.....*Superintendent John Jacob Astor Br. Exp. Sta., Astoria*
L. N. Goodding, B.A., B.S.....*Junior Plant Pathologist, U. S. Department of Agric.*
W. V. Halversen, Ph.D.....*Associate Bacteriologist*
J. R. Haag, Ph.D.....*Chemist*
H. Hartman, M.S.....*Horticulturist (Pom.)*
E. M. Harvey, Ph.D.....*Horticulturist (Physiology)*
D. D. Hill, M.S.....*Assistant Agronomist*
Bertha C. Hite, B.A.....*Scientific Assistant Seed Lab., U. S. D. of A. (Seed Anal't)*
C. J. Hurd, B.S.....*Assistant Agricultural Engineer*
R. E. Hutchinson, B.S.....*Assistant to Supt. of Harney Valley Br. Exp. Sta., Burns*
G. R. Hyslop, B.S.....*Agronomist*
W. T. Johnson, B.S., D.V.M.....*Poultry Pathologist*
I. R. Jones, Ph.D.....*Assoc. Dairy Husband'n*
J. S. Jones, M.S.....*Chemist in Charge*
F. L. Knowlton, B.S.....*Poultry Husbandman*
G. W. Kuhlman, M.S.....*Assistant in Farm Management*
E. S. Larrabee, B.S.....*Dairy Specialist, In Cooperation with U. S. Dept. of Agric.*
M. R. Lewis, B.S.....*Drainage Engineer, Cooperation Bureau of Public Roads*
A. G. Lunn, B.S.....*Poultry Husbandman in Charge*
A. M. McCapes, D.V.M.....*Asst. Veterinarian*
M. B. McKay, M.S.....*Plant Pathologist*
J. F. Martin, B.S.....*Jr. Agron. U. S. D. A.*
G. A. Mitchell, B.S.....*Assistant to Superintendent Pendleton Field Sta., Pendleton*
E. B. Mittelman, Ph.D.....*Associate Agricultural Economist*
Don C. Mote, Ph.D.....*Entomologist in Chg.*
M. N. Nelson, Ph.D.....*Agricultural Economist*
O. M. Nelson, B.S.....*Animal Husbandman*
R. K. Norris, B.S.....*Assistant to Superintendent of S. Or. Br. Exp. Sta., Talent*
A. W. Oliver, M.S.....*Assistant Animal Husbandman*
E. L. Potter, M.S.....*Animal Husbandman in Charge*
W. L. Powers, Ph.D.....*Chief, Dept. of Soils*
F. E. Price, B.S.....*Agricultural Engineer*
F. C. Reimer, M.S.....*Superintendent Southern Oregon Br. Exp. Station, Talent*
G. S. Ridgley.....*Laboratory Technician, Poultry Pathologist*
R. H. Robinson, A.B., M.S.....*Chemist*
C. V. Ruzek, B.S.....*Assoc. in Soils (Fert'y)*
H. A. Schoth, M.S.....*Associate Agronomist, Forage Crops, U. S. Dept. of Agric.*
C. E. Schuster, M.S.....*Horticulturist (Pomology)*
H. D. Scudder, B.S.....*Chief in Farm Management*
Owen Searcy, B.S.....*Technician, Vet. Med.*
H. E. Selby, B.S.....*Associate in Farm Management*
O. Shattuck, M.S.....*Superintendent Harney Valley Branch Experiment Sta., Burns*
J. N. Shaw, D.V.M.....*Asst. Veterinarian*
J. E. Simmons, M.S.....*Asst. Bacteriologist*
B. T. Simms, D.V.M.....*Veterinarian in Chg.*
D. E. Stephens, B.S.....*Superintendent Sherman County Branch Exp. Station, Moro*
R. E. Stephenson, Ph.D.....*Associate Soils Specialist*
B. G. Thompson, M.S.....*Asst. Entomologist*
E. F. Torgerson, B.S.....*Assistant in Soils (Soil Survey)*
A. Walker, B.S.....*Assistant Agronomist, Eastern Oregon Br. Exp. Station, Union*
C. F. Whitaker, B.S.....*Assistant Chemist*
E. H. Wiegand, B.S.....*Horticulturist (Horticultural Products)*
Joseph Wilcox, B.S.....*Asst. in Entomology*
Maud Wilson, B.S.....*Home Economist*
Robt. Withycombe, B.S.....*Superintendent Eastern Oregon Br. Exp. Station, Union*
S. M. Zeller, Ph.D.....*Plant Pathologist*

The Jerusalem Artichoke

By

H. A. Schoth,

Associate Agronomist, Forage Crops, United States Department of Agriculture[1]

INTRODUCTION

Recent investigations and developments in production, utilization, and improvement of the Jerusalem Artichoke (*Helianthus tuberosus* L.) indicate that the plant has a rather distinct and favorable future as a farm crop in Oregon. Its range of usefulness is large, culture comparatively simple, and utility wide. There are many sections in this state where the crop can and is being successfully grown.

Artichokes occupy rather a unique position from the utility standpoint. The whole plant can be successfully used for livestock feed and the tubers for human food and for the manufacture of numerous food and dietary products.

Artichoke tops make fresh forage and silage for cattle and sheep especially. The tubers are consumed by all kinds of livestock. Most of them are used as hog feed. As a human food they are considered by many to be of considerable value. Manufactured food products from artichoke tubers including the very sweet levulose sugar offer large possibilities. The tubers contain dietary properties credited as of material benefit to humans and will be brought into more general use as manufacturing methods are perfected. They may also be a raw material for the manufacture of industrial alcohol.

HISTORY

There is no authentic information regarding the introduction of artichokes into Oregon. It is probable that the cultivated types were brought by early settlers. There is some evidence that foreign and eastern types were grown, especially in Western Oregon during its early settlement. Between 1885 and 1895 interest in artichoke culture was probably at its height. Early publications indicate that at that time the tubers were quite favorably considered as livestock feed. From that time until 1925 the acreage was very small and interest low. Since 1925 the introduction of improved varieties by the Oregon Agricultural Experiment Station and increased utilization possibilities have stimulated a livelier interest. The acreage is now increasing as rapidly as seed of improved varieties can be obtained.

[1]Forage crop work at the Oregon Agricultural Experiment Station is conducted in cooperation with the Office of Forage Crops, Bureau of Plant Industry, United States Department of Agriculture, and credit is hereby acknowledged as jointly due to the above named office and the Oregon Station.

DESCRIPTION AND VARIETIES

The Jerusalem artichoke belongs to the sunflower (*Helianthus*) family. It is an annual, reproduced mainly by tubers that are somewhat similar to potatoes. Seed is rarely used.

The plants of the cultivated varieties grow from 4 to 12 feet in height; stalks are medium coarse, often heavily branched, very leafy, and bear small yellow blossoms on the tips of the upper branches and main stalks. Figure 2 shows artichokes in bloom. The tubers vary from the elongated, usually slender, to the almost round types. They vary in color from red and blue to white and yellow. White tubers are preferred to colored ones. In general, the tubers are rough, the eyes are very numerous and usually even with the surface, and the flesh is white, resembling that of the potato.

Fig. 2. Mammoth French White (Sibley type) Jerusalem artichokes in bloom.

There are several types and varieties of artichokes. The most productive and easiest to cultivate and harvest are those which produce smooth, round-shaped tubers rather closely grouped in the hills. Figure 3 shows a comparison between the wild type and the better type of cultivated artichoke.

The Mammoth French White Jerusalem artichoke is considered the best variety. It was originally introduced by Hon. Joseph C. Sibley of Pennsylvania and is sometimes known as the Sibley-type Artichoke. It is a good producer of reasonably smooth tubers. The tubers are always borne in hills and are easy to harvest. The amount of forage produced is equal to that of other varieties.

There are wild artichokes growing in several sections of the state. Ordinarily these produce considerable top growth but the yield of tubers is small. They are quite often referred to as wild sunflowers.

The varieties having several tubers with long, slender stems between them produce a crop widely scattered throughout the surface soil. These varieties usually produce good top growth. The tubers are often very rough and are always difficult to harvest completely as the entire field surface must be dug over in order to get them.

Fig. 3. Showing types of artichoke tubers. Upper ones are wild type. Center and lower ones, smooth and semi-smooth types of Mammoth French White (Sibley type).

ADAPTATION AND CULTURE

Regional adaptation. The Jerusalem artichoke is apparently adapted to a large part of Oregon, as is shown in Fig. 4. It makes a successful growth throughout Western Oregon and in all sections of Eastern Oregon where ample moisture is available. In the high altitude sections of Central Oregon, full crop growth may not be obtained each year because of occasional summer frosts or early fall freezes. Artichokes make very good growth under irrigation.

Artichokes are now a successful crop in the Coast and Lower Columbia River counties of this state and are producing excellent yields on the mellow, more fertile soils. The Willamette Valley is well adapted to artichoke production. Excellent growth is made on the sandy loam soils,

although yields are somewhat less than in the Coast sections because of dry mid and late summers.

In Eastern Oregon, under irrigated conditions, very good growth is made and good crops are harvested.

Artichokes require a plentiful supply of moisture throughout the growing season. The Coast, Lower Columbia, and lower Willamette Valley sections of Western Oregon are supplied by ample rainfall. In Eastern Oregon, culture is almost exclusively under irrigation.

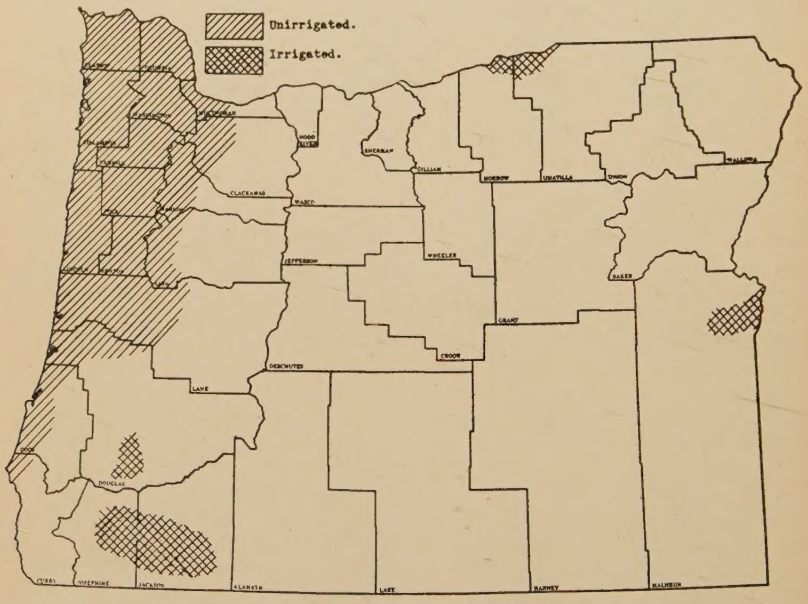

Fig. 4. Map showing districts in Oregon containing good-sized areas where conditions favorable to artichoke growing prevail.

Soils. The Jerusalem artichoke is adapted to all soils except those too wet or too dry or those containing a medium high to high percentage of alkali. In some places it is referred to as a poor-soil plant because it will produce a crop where such plants as potatoes or beets are failures.

Sandy soils of good fertility and ample moisture are the best for artichokes because on such soils the tubers are usually smoother and do not carry so much adhering earth at harvest time. Cultivation is also usually cheaper.

Silty and light clay soils produce excellent crops and the tubers can ordinarily be harvested in reasonably clean condition. For harvesting by livestock a loose, mellow soil is of much advantage as there is a longer harvest season on the quick-drying lands.

Heavy clay or adobe soils with reasonable fertility also produce good crops, but cultivation is expensive, tubers are often very rough, harvest is difficult, and a large amount of earth usually adheres to the tubers when dug. Jerusalem artichokes repay well for good culture.

Fertilizers. Reasonably well decomposed stable manure used at the rate of 8 to 10 tons per acre materially increases the yield of artichokes. Artichokes are heavy users of potash, hence soils low in this element may respond to its use.

In Table I is shown the comparative amounts of plant food removed by artichokes and wheat. This indicates the heavy use of plant food.

TABLE I. SHOWING COMPARATIVE AMOUNTS OF PLANT FOOD REMOVED BY ARTICHOKES AND WHEAT[1]

Crop	Yield per acre	Amount of primary elements		
		Nitrogen	Phosphoric acid	Potash
		lbs.	*lbs.*	*lbs.*
Artichoke tops (dry)	3.5 tons	46.90	20.30	73.50
Artichoke tubers	10 tons	64.00	28.00	98.00
Wheat grain	30 bushels	35.64	15.48	9.54

[1]Henry and Morrison "Feeds and Feeding."

Planting. Planting in Oregon is usually and preferably in the spring. Either fall or spring planting may be done successfully in many sections. Soil preparation should be such that a deep, reasonably fine, and otherwise well prepared seed-bed is obtained. Artichokes should always be planted about 5 inches deep in rows, 36 to 42 inches apart, with plants 18 to 24 inches apart in the row. In some cases they are planted in hills three feet apart each way. This permits cultivation both ways. Tubers may be planted whole or cut like potatoes. When whole tubers are planted, from 8 to 12 sacks of approximately 100 pounds each are required per acre, the amount depending considerably on the size of tubers. When cut into pieces, from 5 to 8 sacks are usually required.

Whole, small tubers are almost as satisfactory as large ones for seed purposes. For cutting, large tubers are more satisfactory than small ones, because the seed pieces are usually larger and the plants produced are more thrifty. Seed stock should be as smooth as possible since indications are that, to a certain degree, smoothness is transmitted in the crop.

Cut tubers should be sprinkled with land-plaster to dry the cut surfaces and prevent decay.

Fall plantings should be made during October so that soil conditions will be as favorable as possible. Mature, whole tubers should be used. Either immature or cut tubers may decay before spring.

Spring plantings should be made during April or early May, since at that time good seed-beds can be prepared and plantings can be made under good conditions. Plantings should be made as early as possible and certainly before May 15. Later plantings make maturity late and yields may be reduced by early fall frosts.

Artichokes are planted like potatoes, using the same machinery and following the same general practices.

Where harvesting by livestock is practiced many tubers are likely to be left in the ground. Some growers, especially those having free working land, grow succeeding crops by simply preparing the soil and depending on remaining or volunteer tubers for a stand. This use of volunteer crops usually results in thick stands and low cost of production. The resulting crops, unless cultivated out to make rows, must of necessity be harvested by livestock or by hand. Machine harvesting would be almost impossible on account of the large amount of earth to

be turned. Cultivation is ordinarily limited. When stands are very thick the tubers are usually small.

Cultivating volunteer stands to reestablish rows is sometimes practiced. Three or four cultivations or hillings with perhaps one hand hoeing will usually result in reasonably good rows from such stands.

Cultivation. Thorough cultivation of artichokes as soon as the plants appear is advisable and profitable. It aids in early weed and moisture control before the rooting system is extensive enough to be injured. Because of its strong-growing, wide-branching habit and heavy foliage, the artichoke is an easy crop to cultivate. No hand cultivation is necessary except for weeds in the row early in the season. After July 1 cultivation is usually discontinued because of the rank growth and shading by the plants.

On lands that are inclined to be wet during the winter, ridging the plants when they are from 8 to 10 inches high is recommended in order that drainage may be provided and tuber rot prevented. Ridging is helpful also where irrigation is practiced and where the crop is to be harvested with a machine digger.

Artichokes are heavy users of water and keep growing vigorously with frequent moderate irrigations. When grown under irrigation, cultivation practices should be similar to those used for potatoes.

Harvesting. Practically all harvesting of tubers in Oregon has been done by hogs. Cattle and sheep have sometimes pastured off the tops in the field.

Tubers may be dug by hand or by machine. The potato digger has been reported as fairly successful. The improved varieties producing the tubers close in hills should be handled quite easily by machinery.

There are two special points to consider in machine digging: (1) When the tops are not harvested or fed off there may be considerable digging interference and clogging of the machine. (2) The tubers grow in large masses close to the base of the stems and often do not separate easily. This makes more work in picking up. Machinery can be used to best advantage on sandy and mellow soils in the fall and spring. Machinery may be used on heavy soils in the fall when not too wet but early spring digging is generally hand work. Harvesting immature artichokes by machinery is difficult if the green tops are not removed first. Tops when harvested for feed may be cut by hand or by machinery. A mowing-machine, sled cutter, or corn-binder work well.

Yields. Few authentic yields of artichokes have been obtained in Oregon, as most of the harvesting has been done by livestock. Only estimates are available from these sources. Such estimates vary from 8 to 60 tons of tubers per acre. Yields from small plots in various sections of the state grown under varying conditions show yields of from 10 to 40 tons of tubers per acre.

Experimental work with artichokes at the Oregon Agricultural Experiment Station during the past seven years show the yields as recorded in Table II. The plantings have all been on clay loam soil, manured at the rate of 10 tons per acre, well cultivated, and with ample moisture available for continual growth. The yields of tops were taken when the plants were in full bloom and the yields of the tubers, when they were mature.

TABLE II. ARTICHOKE YIELDS AT OREGON AGRICULTURAL EXPERIMENT STATION

Variety	Year	Yields: Tubers per acre	Yields: Forage (tops) fresh per acre
		tons	*tons*
Common[1]	1921	9.16	8.56
	1922	8.27	9.42
	1923	8.73	9.32
	1924	6.69	6.58
	1925	9.23	10.65
	1926	7.32	9.20
	1927	6.60	7.25
Mammoth French White	1923	14.85	10.25
	1924	13.25	17.25
	1925	15.22	20.21
	1926	12.16	14.20
	1927	12.82	14.35
	1928	13.12	13.50

[1]Unnamed variety grown in Oregon for many years.

The Mammoth French White variety yielded approximately five tons of tubers per acre more than the Common variety usually grown. The yield of fresh forage was approximately five tons per acre more than that of the Common variety. These figures indicate that the Mammoth French White variety is much superior to the Common variety and can be recommended for this state.

Experimental work carried on at this Station about twenty years ago shows an estimated yield of 740 bushels of tubers per acre. This amounts to about 22 tons per acre.[1]

The Quarterly Bulletin of the Agricultural Experiment Station, Michigan State College, May, 1928 (Vol. X, No. 4) states that "its yield of roots is greatly decreased by cutting the tops at the silage stage in the fall. The roots make their greatest growth late in the fall, and early harvesting of the tops stops the food supply and kills the plant so no further development is possible. If the roots are desired for spring hog pasture the tops should not be cut until fully mature." This is equally true where roots are to be harvested for manufacture.

A compilation of data in the same bulletin is shown in Table III.

TABLE III. EFFECT ON TUBER YIELD OF REMOVAL OF TOPS FOR SILAGE

Variety	Tuber yields per acre: Tops not removed — Dug Oct. 25	Tops not removed — Dug Apr. 16	Tops removed Sept. 25 — Dug Apr. 16
	tons	*tons*	*tons*
Improved White	6.339	5.989	.918
U. S. Dept. of Agric. No. 26719	5.661	6.037	.786
U. S. Dept. of Agric. No. 26723	6.485	6.432	.810

Storage. Artichokes are difficult to store artificially. No adequate storage experiments have been worked out. Dug tubers will remain in good condition in sacks or shallow piles from three to four weeks during cool weather where good ventilation is provided. It is probable that cold storage with temperatures of from 33° to 36° F. will be satisfactory.

[1]French, H. T., 1898. "Feeding Artichokes to Pigs," Ore. Agric. Exp. Sta. Bul. 54:pp.26-28.

There is practically no deterioration in the soil before digging. The tubers keep in excellent condition when left where grown if reasonably good drainage is provided.

There is very little difference in yield when dug late in the fall after the tops have died down as compared to early spring harvesting where drainage is good and rodent damage prevented.

In cold sections it is advisable to cover the tubers with an additional amount of earth to prevent excessive freezing. The tubers can be frozen solid in the ground during long periods and thawed out without injury. They should not be fed while frozen.

ECONOMICS OF ARTICHOKES

Tubers as stock feed. The most extensive use for artichoke tubers now is as stock feed. Hogs, cattle, sheep, and horses relish them and will consume large quantities with generally good results. When fed alone they are too watery and bulky to be a good feed. For best results they should be fed with grain or grain and legume hay.

Feeding experiments with artichokes have been conducted on only a small scale and data are scarce. Much has been written on the subject of their food value but few careful experiments have been conducted to determine just what proportion of rations can be profitably made up of these tubers. Oregon Station Bulletin 54 gives data showing that an acre of artichokes yielding approximately 740 bushels of tubers would produce about 744 pounds of pork when the pigs were each fed about 1.5 pounds of mixed chopped wheat and oats per day in equal amounts. Pigs usually make little gain on artichokes alone.

The Canadian Experiment Farms Report of 1900 shows that pigs allowed to run on a field of artichokes and fed 1.5 pounds of mixed grain a day in addition to the artichokes, gained 1.57 pounds per day at a cost of 1.8c per pound.

In experiments with artichokes for hog pasture in Texas it was found that 4 acres carried 16 head of hogs through the winter in good condition.

At Hawkesbury Agricultural College in New South Wales, 60 pigs were pastured on 1 acre of artichokes and made a gain of one pound per head per day for six weeks. An acre of artichokes produced a ton of pork.

In general the conclusions of feeders and other livestock men is that raw artichoke tubers and cooked potatoes are practically equal pound for pound for hog feed.

Artichokes have several advantages over potatoes: (1) They do not need to be cooked. (2) The number of pounds of tubers produced an acre is larger. (3) They are more frost resistant. (4) The cost of production is less. (5) The tops may be used to advantage in some sections for forage.

When used for hog feed they are usually harvested in the field by the hogs themselves. Occasionally furrows are plowed down the rows to make the tubers more readily accessible. It is advisable to divide large fields into small lots so that there will be less waste.

The harvesting of tubers by livestock usually begins when the plants are in the early blooming stage. If harvested before this the yield is much reduced.

For cattle, sheep, and horses the tubers must be dug. For these animals root crops, such as mangels, carrots, turnips, and rutabagas are generally preferred. For horses, cattle, and sheep it probably takes from 250 to 350 pounds of tubers to equal the feeding value of 100 pounds of grain hay.

As forage. As shown in Table II the amount of green forage produced is large. Cattle and sheep consume the fresh forage readily and farmers using the forage in this condition, either after hauling to the feed lot or by pasturing, report the practice successful and profitable.

No information is available in this state on the value of the dried forage. In Europe it is sometimes so used. Reports from Alaska state that sheep and horses relish artichoke forage.

Artichoke tops make good silage. The yield is quite high and the cost per ton will probably be about the same as for sunflowers. Silage has been made from artichoke tops at this Experiment Station. Cattle consume it readily.

In Tables IV and V are shown comparative analyses of artichoke forage, tubers, and other crops. These analyses show little difference between artichoke tubers and potatoes. Corn fodder shows a generally increased value over that of dried artichoke forage. Artichoke top silage compares quite favorably with corn silage and is much higher in carbohydrates than sunflower silage. According to feeding tests the palatability of artichoke top silage is much higher than that of sunflower silage, but not as high as corn.

In Europe artichoke tops are sometimes cured as hay. The quality and amount consumed depends largely on the size of stalks and percent of leaves. Palatability is low. German reports show that artichoke hay fed alone may cause strong fermentation in the alimentary canal; consequently, not more than one-half of the roughage fed should be artichoke hay.

TABLE IV. ANALYSES OF ARTICHOKES COMPARED TO OTHER FORAGE IN THE SAME CONDITION

Crop	Moisture	Dry matter	Ash	Crude protein	Ether extract (fat)	Crude fiber	Carbohydrates
Artichoke[1] tubers (mature)	79.50	20.50	1.70	2.00	0.10	0.80	15.90
Potatoes[1] (mature)	78.80	21.20	1.10	2.20	0.10	0.40	17.40
Artichoke forage (dried)[1]	25.80	74.20	7.00	4.20	0.09	22.00	40.10
Corn fodder[1]	18.30	81.70	5.00	6.70	2.20	22.00	45.80

[1]Analyses according to Henry and Morrison's "Feeds and Feeding."

TABLE V. COMPARATIVE ANALYSES OF ARTICHOKE TOPS, SUNFLOWER AND CORN SILAGE

Silage	Moisture	Dry matter	Ash	Crude protein	Ether extract (fat)	Crude fiber	Carbohydrates
Artichoke[1] tops	72.74	27.26	2.12	1.41	0.30	4.93	18.50
Sunflower[1]	81.48	18.52	1.92	1.97	0.77	5.07	8.78
Corn[1]	79.18	21.82	1.37	1.85	0.53	4.53	12.54

[1]Analyses by J. S. Jones, Oregon Agricultural Experiment Station. Oregon Agricultural Experiment Station Bulletin 197, A Chemical Study of Legumes and Other Forage Crops of Western Oregon," by J. S. Jones and D. E. Bullis.

When tops are pastured or fed in the feed lot or used for silage the largest tonnage of tops and probably the most nutrition is obtained between the time the first buds appear and the last flowers drop their petals. The artichoke is a very persistent grower and plants cut off several times during the summer will renew their growth and produce a succession of fresh feed. When this method is followed very few tubers are produced.

As a combination livestock feed and forage crop the artichoke produces a large tonnage per acre. Where it can be successfully utilized it is worthy of trial as a feed for livestock.

Are artichokes likely to become a weed pest? Many farmers look on the artichoke as a weed. The wild varieties are weeds and the cultivated varieties, especially those producing long, slender stems with tubers scattered throughout the soil, may easily become weeds.

Eradication is relatively simple. One year's consistent cultivation without allowing the formation of tubers will completely eradicate them.

The spreading characteristic is of some value where volunteer stands are desired.

Varieties producing tubers in hills are much easier to eradicate than other varieties because a larger percentage of the crop is removed in harvesting.

There are comparatively few seeds produced, making reproduction by seeds a very small weed factor.

As a smother crop for weeds. Reference is occasionally made to the probable value of the Jerusalem artichoke as a smother crop. With the preparation of a good seed-bed followed by clean cultivation, a thick stand of the artichokes shades the ground almost completely. Harvesting will also help in further control. Two or three years' cropping of one piece of land to artichokes will result in considerable control if not eradication. It appears of special value in eradication of quack-grass and other low-growing, non-climbing weeds. The artichoke, while probably not as heavy a smother crop as hemp or sunflowers, should be thickly planted and should extend a rod or two beyond the borders of the weed patches.

As human food. At present there is a large amount of interest in the use of artichokes for human food, either fresh or after processing. They have been used for many years as a vegetable and are considered good human food. Many recipes are available for their preparation. As a vegetable, the artichoke is a competitor of the potato. The manufacturing of food products from artichokes is a recent development. Artichoke products are considered to have dietary value. They are high in food value and contain a high percent of sugars, especially levulose. Levulose is of special dietary value for persons having diabetes.

With the expansion of manufacture an increased acreage of artichokes will be required. This will provide a good cash crop if reasonable prices are paid.

Artichokes are one of the best sources of inulin, which has a distinct dietary value. Inulin is an anhydride of levulose. On hydrolysis inulin yields fructose, which is the sugar that can be used by diabetics more readily than glucose or ordinary cane sugar. The Vermont Experiment

Station Report of 1901 shows that artichoke tubers analyze 1.92 percent inulin.

Considerable publicity has been given the artichoke as a new source of sugar, especially levulose. Recent analyses made by the Bureau of Standards, United States Department of Commerce, of artichokes grown at the Oregon Experiment Station are shown in Table V.

TABLE VI. ANALYSES OF MAMMOTH FRENCH WHITE ARTICHOKES FOR SUGAR CONTENT

Stage of maturity	Levulose	Total sugar[1]
	%	%
Full bloom	13.55	15.16
Mature	14.70	18.00

[1]Sucrose and levulose.

These analyses indicate a high percentage of sugar and with recently perfected methods of crystallization the artichoke promises to become a considerable factor in our natural sugar supply.

Table VI shows a higher sugar content for the tubers of the more mature plants.

Fall and spring harvesting makes a long manufacturing season possible. It also gives the grower more time for harvest.

Analyses of tubers harvested in fall and spring according to P. Behrend (Journ. Landw.) 52 (1904) shows comparatively little difference indicating very little deterioration in the soil during the winter. Table III shows but little difference in yield between fall and spring harvest.

COST OF PRODUCTION

No definite figures are available on the cost of production of artichokes.

The following estimates cover within a reasonable range the cost of production in this state.

ESTIMATED COST OF GROWING JERUSALEM ARTICHOKES

Plowing (per acre)	$ 3.50
Disking and harrowing (per acre)	4.00
Seed (per acre)	6.00
Seed preparation and planting (per acre)	4.00
Three cultivations @ 75c each (per acre)	2.25
Harvesting and delivering (per acre)	40.00
Taxes (annual) (per acre)	1.50
Interest on land value (per acre)	9.00
Fertilizer (manure) (per acre)	10.00
	$80.25

If grown under irrigation the cost of irrigation and water must be added. This, on the average, would amount to approximately $8.00 per acre.

Figures in Table II show yields of Mammoth French White artichokes to be from 12 to 15 tons per acre at Corvallis, Oregon, on clay loam soils. Yields generally may be expected to vary from 5 to 20 tons per acre. Unofficial reports from other sections of the state show yields of from 10 to 40 tons per acre. Prices offered in Oregon have varied

from $10.00 to $20.00 per ton, although no general price level has been established.

A majority of the expenditures as listed can be figured as income to the grower and his family for their field work. Power machinery will probably reduce cost of production. Cost of fertilizer is variable and the figure here given is for stable manure.

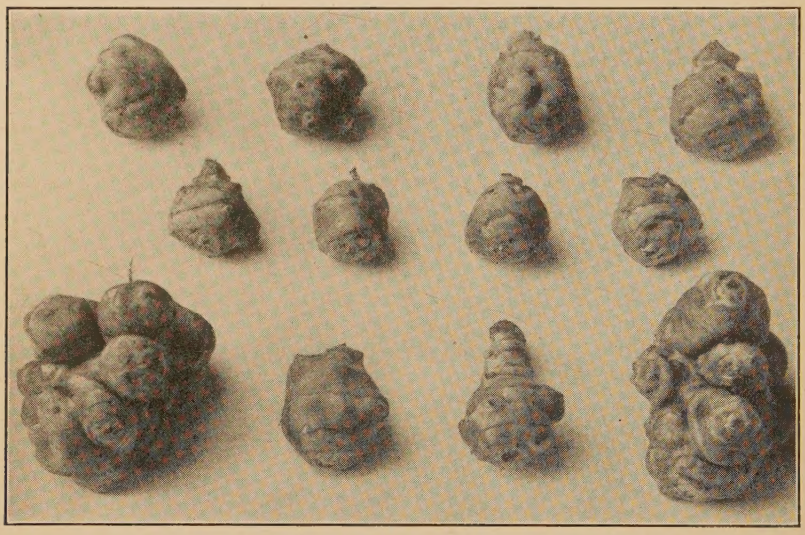

Fig. 5. Types of tubers of Mammoth French White artichokes. Smooth, medium-sized tubers are most desirable.

DISEASES, PESTS, AND RODENTS

At present there are no important disease or insect pests known to attack the artichoke in this state. When stored, the tubers are attacked by storage rots. Attempts should not be made to store artichokes until more successful methods are found.

Artichokes are occasionally attacked by stem rot, *Sclerotinia sclerotiorum*. This disease, while of minor importance, also attacks potatoes and lettuce. Rotation is the best means of control. Diseased hills should be removed and destroyed.

Occasionally slugs will damage exposed tubers during the fall, winter, and early spring months.

Field-mice sometimes destroy considerable quantities of tubers during the winter months when they locate in an artichoke field. Gophers are troublesome during both the growing and dormant seasons. Field-mice and gophers are easily poisoned. Gophers may also be successfully trapped.

IMPROVEMENT

The possible improvement of the Jerusalem artichoke by the farmer depends largely on field selection. Hills producing heavy yields of

smooth tubers of good size, free from disease, should be saved for seed stock. The tubers should be close together or well collected in the hills so that they can be dug by machinery. This selection may, to a certain degree, result in increased yields of better-quality tubers. Figure 5 shows the different types of tubers.

As the manufacture of artichoke products assumes importance, selection must also be on the basis of inulin and sugar (levulose) content.

The obtaining of earlier maturing varieties is also of value in order to lengthen the harvest season.

The farmer or commercial grower in general cannot do improvement work by growing and selecting seedlings or attempting to make crosses of the various types since such work is slow, results for the most part negative, and the work is expensive to follow to conclusion.

SUMMARY

Jerusalem artichokes are becoming an increasingly valuable farm crop in Oregon.

The Mammoth French White variety is the best yielder of smooth tubers produced in hills and is easy to harvest.

Artichokes are adapted to most sections of Western Oregon and to the irrigated sections of Eastern Oregon where the growing season is long enough for maturity.

They produce heaviest crops on mellow sandy or silty soils with good fertility and moisture.

Planting in the spring is best. Culture is similar to that for potatoes.

Harvesting of tubers and tops may be done by livestock, by hand, or with machinery.

Yields of tubers of the Mammoth French White variety at the Oregon Agricultural Experiment Station have been from 12.16 to 15.22 tons per acre. Yields of tops at the silage stage have been from 10.25 to 20.21 tons per acre.

Artichokes are left in the ground until used. They are not injured by frost and loss in the ground is small. Present storage methods are unsatisfactory. Removal of tops for silage seriously reduces tuber yields.

Artichokes are now used most extensively for stock feed. The raw tubers are considered equal to cooked potatoes for hog feed.

Tops may be used for silage or fed fresh. Palatability of artichoke silage is higher than that of sunflowers but not so high as corn.

Artichokes can be eradicated by one year's thorough, clean cultivation.

The use of artichokes for human food is increasing in importance because of their dietary value. The tubers are high in levulose and inulin. These are of especial value to persons having diabetes.

No serious insect or disease pests of artichokes are known in Oregon at present.

Growers of artichokes should select and save for seed plants producing large crops of smooth tubers well bunched in the hill.